

इंटरनेट

मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 11852-3 (2001): Automotive vehicles - brakes and braking systems, Part 3: Performance requirements and evaluation
[TED 4: Automotive Braking Systems]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrihari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

BLANK PAGE



भारतीय मानक
स्वचल वाहन — ब्रेक और ब्रेकिंग प्रणाली
भाग 3 कार्यकारिता अपेक्षाएं और मूल्यांकन
(पहला पुनरीक्षण)

Indian Standard
AUTOMOTIVE VEHICLES — BRAKES AND
BRAKING SYSTEMS
PART 3 PERFORMANCE REQUIREMENTS AND EVALUATION
(*First Revision*)

ICS 43.040.40

© BIS 2001

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

FOREWORD

This Indian Standard (Part 3) (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Automotive Braking Systems Sectional Committee had been approved by Transport Engineering Division Council.

This Indian Standard on brakes and braking systems which was earlier issued in eight parts, has now been revised and issued in nine parts which are as under:

- Part 1 Terminology;
- Part 2 General functions and features;
- Part 3 Performance requirements and evaluation;
- Part 4 Compressed air and air assisted brakes — Special requirements;
- Part 5 Compressed air and air assisted brakes — Pressure test connections;
- Part 6 Vacuum braking systems — Special requirements;
- Part 7 Inertia dynamometer test method for brake linings;
- Part 8 Test procedures; and
- Part 9 Requirements for vehicles equipped with anti-lock braking devices.

IS 11852 (Part 7) : 1995 'Automotive vehicles — Recommendations for brakes and braking systems: Part 7 Model test report' has been withdrawn in this revision and has been replaced with a part covering 'Inertia dynamometer test methods for brake linings'. Part 9 covering the requirements for vehicles equipped with anti-lock braking devices has been added.

This part of the Indian Standard has been prepared to help the vehicle manufacturers in designing suitable brake systems for various types of vehicles and also in evaluating the performance of the same by the manufacturers as well by consumers.

This standard is mainly based on EEC directives 71/320, 74/132, 75/524, 79/489, 85/647, 88/194 and 91/422 EEC relating to the braking devices of certain categories of motor vehicles and of their trailers. However, apart from the changes made from EEC directives to suit the Indian conditions, the nomenclature of some of the tests and categories of vehicle have also been changed as under:

<i>EEC Directives</i>	<i>Indian Standards</i>
Category 'O' Vehicle	Category 'T' Vehicle
Type 'O' test	Type 'P' test
Type I test	Type 'F' test
Type II test	Type 'H' test

The composition of the committee responsible for formulating this standard is given in Annex B.

AMENDMENT NO. 1 NOVEMBER 2003
TO
IS 11852 (Part 3) : 2001 AUTOMOTIVE
VEHICLES —BRAKES AND BRAKING SYSTEMS
PART 3 PERFORMANCE REQUIREMENTS AND EVALUATION
(First Revision)

[Page 1, clause 1.1(f)] — Substitute 'Three wheelers' for 'Three wheelers having maximum mass not exceeding 1.5 tonne'.

(Page 4, clause 4.1.1.1) — Substitute '120' for '160' in column 2 of table under 4.1.1.1 against 'Type P test with engine connected'.

(TED 4)

Reprography Unit, BIS, New Delhi, India

Indian Standard

AUTOMOTIVE VEHICLES — BRAKES AND BRAKING SYSTEMS

PART 3 PERFORMANCE REQUIREMENTS AND EVALUATION

(*First Revision*)

1 SCOPE

This standard (Part 3) covers the various braking tests applicable to M, N and T categories of road vehicles, their performance requirements and methods of evaluation.

1.1 This standard is not applicable to the following type of vehicles:

- a) Agricultural tractors and power tillers;
- b) Earth moving machinery;
- c) Construction equipment vehicles;
- d) Vehicles moving on rails;
- e) Two wheelers;
- f) Three wheelers having maximum mass not exceeding 1.5 tonne; and
- g) Vehicles with maximum designed speed not exceeding 25 km/h.

1.2 This standard also covers information on cases in which certain tests may not be carried out on a vehicle submitted for Type Approval (see Annex A).

2 REFERENCES

2.1 The following standards contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	Title
11852	Automotive vehicles — Brakes and braking systems:
(Part 2) : 2001	General functions and features (<i>first revision</i>)
(Part 4) : 2001	Compressed air and air assisted brakes — Special requirements (<i>first revision</i>)
(Part 7) : 2001	Inertia dynamometer test method for brake linings

3 BRAKING TESTS

3.1 General

3.1.1 The performance specified for braking devices shall be based on stopping distance and/or the mean fully developed deceleration. The performance of a braking device shall be determined by measuring the stopping distance in relation to the initial speed of the vehicle and/or by measuring the mean fully developed deceleration during the test.

3.1.1.1 The stopping distance shall be the distance covered by the vehicle from the moment when the driver begins to actuate the control of the braking system until the moment when the vehicle stops; the initial vehicle speed (V_i) shall be the speed at the moment when the driver begins to actuate the control of the braking system; the initial speed shall not be less than 98 percent of the prescribed speed for the test in question. The mean fully developed deceleration d_m shall be calculated as the deceleration averaged with respect to distance over the interval V_b to V_e according to the following formula:

$$\text{MFDD} (d_m) = \frac{V_b^2 - V_e^2}{25.92 (S_e - S_b)} \text{ m/s}^2$$

where

V_i = as defined above,

V_b = vehicle speed at 0.8 V_i in km/h,

V_e = vehicle speed at 0.1 V_i in km/h,

S_b = distance travelled between V_i and V_b in meters, and

S_e = distance travelled between V_i and V_e in meters.

The speed and distance shall be determined using instrumentation having an accuracy of ± 1 percent at the prescribed speed for the test. The d_m may be determined by other methods than the measurement of speed and distance; in this case, the accuracy of the d_m shall be within ± 3 percent.

3.1.2 The braking performance shall be measured during road tests conducted in the following conditions.

3.1.2.1 The vehicle's condition as regards mass shall be as prescribed for each type of test and be specified in the test report.

3.1.2.2 The test shall be carried out at the speeds prescribed for each type of test. Where vehicle is so constructed that its maximum speed is lower than that prescribed for a test, the test shall be performed at 90 percent of the maximum speed of the vehicle.

3.1.2.3 During the tests, the force applied to the brake control in order to obtain the prescribed performance shall not exceed the maximum force laid down for the test vehicle's category. The force measured at speeds below 5 km/h need not be considered.

3.1.2.4 The road surface shall be dry with a coefficient of adhesion to be greater than 0.8, for example dry tarmacadam as measured using Portable Pendulum type friction tester.

3.1.2.5 The test shall be performed with the wind velocity less than 3 m/s in any direction.

3.1.2.6 At the start of the tests the tyres shall be inflated when cold to the pressure prescribed by the vehicle manufacturer for the load actually borne by the wheels when the vehicle is stationary.

3.1.2.7 The prescribed performance shall be obtained without locking of the wheels. However, brief wheel locking towards the end up to 3 m is permissible provided if the vehicle does not go out of a lane of width equal to one and half times width of the vehicle and the prescribed performance is met. There shall not be any abnormal vibration of the vehicle. In case of vehicles fitted with ABS, momentary wheel locking is permitted.

3.1.3 Behaviour of the Vehicle During Braking

In braking tests, and in particular in tests at high speed, the general behaviour of vehicle during braking shall be checked and reported.

3.2 Type P Test — (Ordinary Performance Test with Brakes Cold)

3.2.1 General

3.2.1.1 The brakes shall be cold. A brake is deemed to be cold when the temperature measured on the disc or on the outside of the drum is below 100°C.

3.2.1.2 The test shall be conducted in the following conditions:

- a) The vehicle shall be laden, the distribution of its mass among axles being that specified by the manufacturer. Where provision is made for several arrangements of load on the axles, the distributions of the maximum mass among

the axles shall be such that load on each axle is proportional to the maximum permissible load for each axle. In the case of tractive units for semi-trailers, the load may be repositioned approximately half-way between the king pin position resulting from the above loading conditions and the centreline of the rear axle/axles.

- b) Type "P" test shall be repeated on the unladen vehicle as per 2.4 of IS 11852 (Part 2).
- c) The limits prescribed for minimum performance, both for tests with the vehicle unladen and for tests with the vehicle laden, shall be those specified for each category of vehicle. The vehicle shall satisfy both the specified stopping distance and/or the specified mean fully developed deceleration for the relevant vehicle category, but it may not be necessary to actually measure both parameters by separate test.
- d) The road shall be level and the longitudinal gradient shall not exceed one percent.

3.2.2 Type P Test

3.2.2.1 Engine disconnected

The test shall be carried out at the speed prescribed for the category to which the vehicle belongs, the figures prescribed in this connection being subjected to ± 5 percent tolerance. The minimum performance prescribed for each category shall be attained.

3.2.2.2 Engine connected

Additional tests shall be carried out at various speeds with the engine connected, the lowest being equal to 30 percent of the maximum speed of the vehicle and the highest being equal to 80 percent of that speed. The maximum practical performance figures shall be measured and the behaviour of the vehicle shall be recorded in the test report.

Further tests shall be carried out with the engine connected, at the speed specified for the category to which the vehicle belongs, the minimum performance specified for such category of vehicle shall be attained. [Tractive units for semi-trailers artificially loaded to simulate the effects of a laden semi-trailer shall not be tested beyond 80 km/h].

3.2.3 Type 'P' Test for Vehicles of Category 'T' Equipped with Compressed Air Brakes

3.2.3.1 The braking performance of the trailer can be calculated either from the braking rate of the towing vehicle plus the trailer and the measured thrust on the coupling or, in certain cases, from the braking rate

of the towing vehicle plus the trailer with only the trailer being braked. The engine of the towing vehicle shall be disconnected during the braking test. In the case where only the trailer is braked, to take account of the extra mass being retarded, the performance shall be taken to be the mean fully developed deceleration.

3.2.3.2 With the exception of cases according to 3.2.3.3 and 3.2.3.4, it is necessary for the determination of the braking rate of the trailer to measure the braking rate of the towing vehicle plus the trailer and the thrust on the coupling. The towing vehicle shall meet the requirements laid down with regard to the relation between the ratio T_M/P_M and the pressure P_M . The braking rate of the trailer shall be calculated according to the following formula:

$$Z_R = Z_{R+M} + D/PR$$

where

Z_R = braking rate of the trailer,

Z_{R+M} = braking rate of the towing vehicle plus the trailer,

PR = total normal static reaction between road surface and the wheels of the trailer, and

D = thrust on the coupling.

NOTE — D shall be considered as positive if the thrust is tensile that is tractive and negative if it is compressive.

3.2.3.3 If a trailer has a continuous or semi-continuous braking device, where the pressure in the brake actuators does not change during braking despite the dynamic axle load shifting, in that case semi-trailer alone may be braked. The braking rate of the trailer is calculated according to the following formula:

$$Z_R = \frac{(Z_{R+M} - R) \times (PM + PR)}{PR} + R$$

where

R = rolling resistance value = 0.01, and

PM = total normal static reaction between road surface and wheels of towing vehicles for trailer or semi-trailer.

3.2.3.4 Alternatively, the evaluation of the braking rate of the trailer may be carried out by braking the trailer alone. In the case of trailers with pneumatic brake, the pressure used shall be the same as that measured in the brake actuators during the braking of the combination.

3.3 Type F Test (Fade Test)

3.3.1 With Repeated Braking

3.3.1.1 The service brakes of vehicles in categories

M1, M2, M3, N1, N2 and N3 shall be tested by successively applying and releasing the brakes a number of times, the vehicle be laden, in accordance with the conditions shown in the following table:

Category of vehicle	Conditions			
	V_1 km/h	V_2 km/h	Δt	n
M1	$80\% V_{Max} \leq 120$	$1/2 V_1$	45	15
M2	$80\% V_{Max} \leq 100$	$1/2 V_1$	55	15
M3	$80\% V_{Max} \leq 60$	$1/2 V_1$	60	20
N1	$80\% V_{Max} \leq 120$	$1/2 V_1$	55	15
N2	$80\% V_{Max} \leq 60$	$1/2 V_1$	60	20
N3	$80\% V_{Max} \leq 60$	$1/2 V_1$	60	20

where

V_1 = initial speed, when braking starts, km/h;

V_2 = speed at end of braking, km/h;

V_{Max} = maximum speed of the vehicle, km/h;

n = number of times brakes applied; and

Δt = duration of a braking cycle (time elapsing between the initiation of one brake application and the initiation of the next), seconds.

3.3.1.2 If the characteristics of the vehicle do not allow for the period of time prescribed for Δt , the duration may be increased. In any event, in addition to the time necessary for braking and accelerating the vehicle, a period of 10 s must be allowed in each cycle for stabilising the speed V_1 .

3.3.1.3 In these tests, the force applied to the control, shall be so adjusted as to attain mean fully developed deceleration of 3 m/sec² at the first application of the brakes. This force shall remain constant throughout the succeeding brake applications.

3.3.1.4 During brake applications the appropriate gear shall be continuously engaged.

3.3.1.5 For regaining speed after braking, the gearbox shall be used in such a way as to attain the speed V_1 in the shortest possible time (maximum acceleration allowed by the engine and gearbox).

3.3.2 With Continuous Braking

3.3.2.1 The service brakes of trailers of categories T2, T3 and T4 shall be tested in such a manner that, the vehicle being laden, the energy input to the brakes is equivalent to that recorded in the same period of time with a laden vehicle driven at a steady speed of 40 km/h on a 7 percent down gradient for a distance of 1.7 km.

3.3.2.2 The test shall be carried out on a level road, the trailer being towed by a motor vehicle during the test. The force applied to the control shall be adjusted so as to keep the resistance of the trailer constant (7 percent of the mass of the trailer). If the power available for hauling is insufficient, the test can be conducted at a lower speed but over a greater distance, as shown in the following table:

<i>Speed</i> (km/h)	<i>Distance</i> (metres)
40	1 700
30	1 950
20	2 500
15	3 100

3.3.3 Hot Performance

3.3.3.1 Immediately after the test described in 3.3.1 or test described in 3.3.2, the residual performance of the service braking device shall be measured under the same conditions as for the Type P test with the engine disconnected (the temperature conditions may be different). This residual performance shall not be less than 80 percent of that prescribed for the category in question and not less than 60 percent of the figure recorded in the Type P test with the engine disconnected. In calculating the residual performance requirements, the percentages are to be applied to the second term of polynomial expression for stopping distance given in 4.1.1.1(a).

3.3.3.2 In the case of a motor vehicle which satisfies the 60 percent requirement specified in 3.3.3.1 but fails to comply with the 80 percent requirement specified in 3.3.3.1, a further hot performance test may be carried out immediately using a control force not exceeding that specified in 4.1.1.1.

The results of both tests shall be recorded in the report.

**3.4 Type H Test — (Downhill Behaviour Test)
[Applicable for M3 and N3]**

3.4.1 Laden vehicle shall be towed at a constant speed of 30 km/h for a distance of 6 km, with the drawbar pull being maintained at 6 percent of the gross vehicle weight by applying suitable force to the service brake

control. During this run, exhaust brake and other retarders, if fitted, shall be made use of. The gear engaged shall be such that the speed in revolutions per minute (rpm) of the engine does not exceed the maximum value prescribed by the manufacturer.

3.4.2 At the end of the test, the hot performance of the service braking device shall be measured in the same conditions as for the Type 'P' test with the engine disconnected (the temperature conditions, of course are different). For motor vehicles, this hot performance shall give a stopping distance not exceeding the following values and a mean fully developed deceleration not less than the following values, using a control force not exceeding 700 N.

Category M3 : $S = 0.15 V + 1.33 V^2/130$

Where, the term $1.33 V^2/130$ corresponds to a mean fully developed deceleration of 3.75 m/s^2

Category N3 : $S = 0.15 V + 1.33 V^2/115$

Where, the term $1.33 V^2/115$ corresponds to a mean fully developed deceleration of 3.3 m/s^2

S = stopping distance

V = test speed for that category of vehicle

However, in the case of trailers the residual brake force at the periphery of the wheels when tested at 40 km/h shall not be less than 33 percent of the force corresponding to the maximum mass borne by the wheels when the vehicle is stationary.

3.4.3 For vehicles in which the energy is absorbed by the braking action of the engine and exhaust brake alone, a tolerance of $\pm 5 \text{ km/h}$ on the average speed shall be permitted, and the gear enabling the speed to be stabilised at the value closest to 30 km/h on the 6 percent down gradient shall be engaged. If the performance of the braking action of the engine and exhaust brake alone is determined by a measurement of deceleration, it shall be sufficient if the mean deceleration measured is at least 0.5 m/sec^2 . That means, if the mean deceleration obtained during this test is $> 0.5 \text{ m/s}^2$, the vehicle shall be treated as having passed the Type 'H' test.

4 PERFORMANCE OF BRAKING DEVICES**4.1 Vehicles of Categories M and N****4.1.1 Service Braking Devices****4.1.1.1 Provisions relating to tests**

- the service brakes of vehicles of categories M and N shall be tested under the conditions shown in the following table:

Type of Test	M1	M2	M3	N1	N2	N3
	P-F	P-F	P-F-H	P-F	P-F	P-F-H
Type P test with engine disconnected	V (km/h) 80	60	60	80	60	60
	S (m) $Max \leq 0.1 V + V^2/150$	$\leq 0.15 V + V^2/130$				
	d_m (m/s ²) > 5.8 (Min)	5.0				
Type P test with engine connected	V (km/h) 160 = 80 percent V_{Max} but less than	100	90	120	100	90
	S (m) $Max < 0.1 V + V^2/130$	$0.15 V + V^2/103.5$				
	d_m (m/s ²) > 5.0 (Min)	4.0				
	F (N) $\leq 500 N$	$\leq 700 N$				

where

V = test speed, km/h;

S = stopping distance, m;

d_m = mean fully developed deceleration, M/S²;

F = force applied to foot-control, Newtons (N); and

V_{Max} = maximum speed of the vehicle.

4.1.2 Secondary Braking Devices

4.1.2.1 The performance of the secondary braking device shall be checked by Type P Test with engine disconnected from the following initial speeds:

M1 = 80 km/h M2 = 60 km/h M3 = 60 km/h

N1 = 70 km/h N2 = 50 km/h N3 = 40 km/h

4.1.2.2 The secondary braking device, even if the control which actuates it is also used for other braking functions, shall give a stopping distance not exceeding the following values at a mean fully developed deceleration not less than the following values:

Category M1 : $S = 0.1 V + 2 V^2/150$

— where the term $2 V^2/150$ corresponds to a mean fully developed deceleration of 2.9 m/s²

Category M2, M3 : $S = 0.15 V + 2 V^2/130$

— where the term $2 V^2/130$ corresponds to a mean fully developed deceleration of 2.5 m/s²

Category N : $S = 0.15 V + 2 V^2/115$

— where the term $2 V^2/115$ corresponds to a mean fully developed deceleration of 2.2 m/s²

4.1.2.3 If the secondary braking control is a hand control, the prescribed performance shall be obtained by applying to the control, a force not exceeding 400 N in the case of category M1 vehicles and 600 N in the case of other vehicles; the control shall be so placed that it can be easily and quickly actuated by the driver.

4.1.2.4 If the secondary braking control is a foot control, the prescribed performance shall be obtained by applying to the control, a force not exceeding 500 N in the case of category M1 vehicles and 700 N in the case of other vehicles; the control shall be so placed that it can be easily and quickly actuated by the driver.

4.1.2.5 The secondary braking effectiveness test shall be conducted by simulating the actual failure conditions in the service braking systems.

4.1.3 Parking Braking Devices

4.1.3.1 The parking braking device shall be capable of holding a laden vehicle stationary on a 18 percent (10.2°) up or down gradient.

4.1.3.2 On vehicles to which the coupling of a trailer is authorised, the parking braking device of the towing

IS 11852 (Part 3) : 2001

vehicle shall be capable of holding the combination of vehicles stationary on a 12 percent (6.8°) up or down gradient.

4.1.3.3 If the control is a hand control, the force applied to it shall not exceed 400 N in the case of category M1 vehicles and 600 N in the case of all other vehicles.

4.1.3.4 If it is a foot control, the force exerted on the control shall not exceed 500 N in the case of category M1 vehicles and 700 N in the case of all other vehicles.

4.1.3.5 A parking braking device which has to be actuated several times before attaining the prescribed performance is admissible provided that the parking brake control is not common with the secondary brake control.

4.1.3.6 To check compliance with the requirements 4.2.1.2 (d) of IS 11852 (Part 2), a Type P test shall be carried out with the engine disengaged, at the initial speed of 30 kmph. The mean fully developed deceleration on application of the parking brake, and the deceleration immediately before the vehicle stops, shall be not less than 1.5 m/s². The test shall be carried out with the vehicle laden. The force exerted on the braking control shall not exceed the specified value.

4.1.4 Residual Service Braking After Transmission Failure

4.1.4.1 The residual performance of the service braking device in the event of failure in a part of its transmission shall not be greater than the following stopping distances and less than the corresponding mean deceleration using a force applied to the control not exceeding 700 N, when checked by the Type P test with the engine disconnected from the following initial speeds for the relevant vehicle category.

4.1.4.2 The residual braking effectiveness test shall be conducted by simulating the actual failure conditions in the service braking system.

4.2 Vehicles of Category T

4.2.1 Service Braking Devices

4.2.1.1 Requirement relating to tests of category T1 vehicles

- a) Where a service braking device is fitted, the performance of the device shall meet the requirements laid down for category T2 vehicles.

4.2.1.2 Requirements relating to tests of category T2 vehicles

- a) If the service braking device is of the continuous or semi-continuous type, the sum of the forces exerted at the periphery of the braked wheels shall be at least X percent of the maximum stationary wheel load, X having the

Stopping Distance (m) and MFDD (m/s²)

Category of Vehicle	Initial Speed km/h	Laden		Unladen	
		Stopping Distance m Max	MFDD m/s ² Min	Stopping Distance (m) Max	MFDD m/s ² Min
M1	80	$0.1 V + \frac{100}{30} \times \frac{V^2}{150}$	1.7	$0.1 V + \frac{100}{25} \times \frac{V^2}{150}$	1.5
M2	60	$0.15 V + \frac{100}{30} \times \frac{V^2}{130}$	1.5	$0.15 V + \frac{100}{25} \times \frac{V^2}{130}$	1.3
M3	60	$0.15 V + \frac{100}{30} \times \frac{V^2}{130}$	1.5	$0.15 V + \frac{100}{30} \times \frac{V^2}{130}$	1.5
N1	70	$0.15 V + \frac{100}{30} \times \frac{V^2}{115}$	1.3	$0.15 V + \frac{100}{25} \times \frac{V^2}{115}$	1.1
N2	50	$0.15 V + \frac{100}{30} \times \frac{V^2}{115}$	1.3	$0.15 V + \frac{100}{25} \times \frac{V^2}{115}$	1.1
N3	40	$0.15 V + \frac{100}{30} \times \frac{V^2}{115}$	1.3	$0.15 V + \frac{100}{30} \times \frac{V^2}{115}$	1.3

following values:

Full trailer, laden and unladen	50
Semi-trailer, laden and unladen	45
Center axle trailer, laden and unladen	50

Where the trailer is fitted with compressed air brakes, the pressure in the control line and in the supply line shall not exceed 7 bar and 6.5 bar respectively during the brake test. The test speed is 60 km/h. A supplementary test at 40 km/h shall be carried out with the laden vehicle for comparison with the Type F test result.

- b) In addition, these vehicles shall be subjected to the Type F test.
- c) In the Type F test of a semi-trailer, the weight braked by its axles shall be corresponding to the load on the axles of the semi-trailer when it is carrying its maximum load.

4.2.1.3 Requirements relating to the testing of category T3 vehicles

The requirements are same as applicable to Category T2 vehicles.

4.2.1.4 Requirements relating to tests of category T4 vehicles

- a) The same requirements apply as applicable to category T2, in addition, these shall be subjected to the Type H test.
- b) In the Type F and Type H tests of a semi-trailer, the weight braked by its axles shall be that corresponding to the load on the axle or axles of the semi-trailer when the latter is carrying its maximum load.

4.2.2 Parking Braking Devices

4.2.2.1 The parking brake with which the trailer or semi-

trailer is fitted shall be capable of holding the laden trailer or semi-trailer stationary when separated from the towing vehicle, on an 18 percent up or down gradient. The force applied to the control shall not exceed 600 N.

4.2.3 Automatic Braking

4.2.3.1 The automatic braking performance in the event of a total pressure loss in the air supply line when testing the laden vehicle from 40 km/h shall not be less than 13.5 percent of the force corresponding to the maximum mass borne by the wheels when the vehicle is stationary. Wheel-locking at performance levels above 13.5 percent is permitted.

4.3 Reaction Time

Where a vehicle is fitted with a service braking system which is totally or partially dependent on a source of energy other than the muscular effort of the driver, the following requirements shall be satisfied.

4.3.1 In an emergency maneuver, the time elapsing between the moment when the control begins to be actuated and the moment when the braking force on the least favourably placed axle reaches the level corresponding to the prescribed performance shall not exceed 0.6 s.

4.3.2 In the case of vehicles fitted with compressed-air braking systems, the requirements of 4.3.1 are considered to be satisfied if the vehicle complies with the provisions as per 4 of IS 11852 (Part 4).

4.3.3 In the case of vehicles fitted with hydraulic braking systems, the requirements of 4.3.1 are considered to be satisfied if, in an emergency maneuver, the deceleration of the vehicle, or the pressure at the least favourable brake cylinder, reaches a level corresponding to the prescribed performance within 0.6 s.

ANNEX A

(Clause 1.2)

CASES IN WHICH TYPE F AND/OR TYPE H TEST NEED NOT BE CARRIED OUT ON A VEHICLE SUBMITTED FOR TYPE APPROVAL

A-1 Type F and/or Type H tests need not be carried out on a vehicle submitted for type approval in the following three cases.

A-1.1 Where the vehicle in question is a motor vehicle, a trailer or a semi-trailer which, in respect of tyres, braking energy absorbed by each axle and method of fitting of tyres and brakes, is identical, as far as braking is concerned, to a motor vehicle, a trailer, or a semi-trailer which:

- a) has passed a Type F and/or Type H test; and
- b) has been type approved, with regard to braking energy absorbed, for axle masses greater than or equal to those of the vehicle submitted for type approval.

A-1.2 Where the vehicle in question is a motor vehicle, a trailer or a semi-trailer of which the axle or axles, in respect of tyres, braking energy absorbed by each axle and method of fitting of tyres and brakes, is or are identical, as far as braking is concerned, to an axle or axles which has or have individually passed a Type F and/or Type H test for axle masses greater than or equal to those of the vehicle submitted for type approval, provided that the braking energy absorbed by each axle does not exceed the energy absorbed by that axle during the reference test or tests carried out separately on that axle.

A-1.3 Where the vehicle submitted for type approval is fitted with a retarder, other than an engine brake,

identical to a retarder which has already been tested under the following conditions.

A-1.3.1 In a test carried out on a gradient at least 6 percent (Type H test), this retarder has on its own, stabilized the speed of a vehicle with a maximum mass at the time of testing at least equal to the maximum mass of the vehicle submitted for type approval.

A-1.3.2 During the test, a check shall be made as to whether the speed of rotation of the revolving parts of the retarder is such that, when the vehicle submitted for type approval is travelling at a speed of 30 km/h, the retarding torque is at least equal to the retarding torque in the test mentioned in A-1.3.1.

A-2 The term 'identical' as used in A-1.1, A-1.2 and A-1.3 means identical as regards the geometrical and mechanical characteristics of the vehicle parts mentioned in these items, as well as the characteristics of the materials from which these parts are made.

A-3 When tests in accordance with the provisions in A-1 are not carried out, test report shall contain the following information.

A-3.1 Where A-1.1 is applicable, the approval number of the vehicle serving as the reference in which Type F and/or Type H tests have been carried out.

A-3.2 Where A-1.2 is applicable, the table in SI No. xiv (b) (2) of IS 11852 (Part 7) shall be completed.

A-3.3 Where A-1.3 is applicable, the table in SI No. xiv (h) (3) of IS 11852 (Part 7) shall be completed.

ANNEX B**(Foreword)****COMMITTEE COMPOSITION****Automotive Braking System Sectional Committee, TED 4***Chairman*

SHRI R. C. SETHI

Representing

VRDE, Ahmednagar

Members

SHRI N. KURUPPAIAH
SHRI K. SENTHIL KUMAR (Alternates to Shri R. C. Sethi)

SHRI VIJAY KUMAR
SHRI RAJESH GOYAL (Alternate)

Allied Nippon Ltd, New Delhi

SHRI R. R. G. MENON

Ashok Leyland Ltd, Chennai

SHRI B. GHOSH
SHRI M. S. OGALE (Alternate)

Automotive Research Association of India, Pune

SHRI T. M. BALARAMAN
SHRI C. Y. DESHPANDE (Alternate)

Bajaj Auto Ltd, Pune

SHRI V. S. VENKATESAN
SHRI K. N. BALAJI (Alternate)

Brakes India Ltd, Chennai

SHRI H. CHANDIRAMANI
SHRI R. M. KANITKAR (Alternate)

Bajaj Tempo Ltd, Pune

SHRI D. G. SHIRKE
SHRI V. R. JALGAONKAR (Alternate)

Central Institute of Road Transport, Pune

SHRI D. K. SHUKLA
SHRI D. CHATTERJEE (Alternate)

Controllorate of Quality Assurance (Vehicles), Jabalpur

SHRI DINESH TYAGI
SHRI D. DOGRA (Alternate)

Daewoo Motors India Ltd, Dadri

SHRI S. VENKATATESH
SHRI S. JAYA KUMAR (Alternate)

Eicher Motors Ltd, Pithampur

SHRI S. RAMASWAMY
DR V. G. NAIK (Alternate)

Hindustan Composites Ltd, Mumbai

SHRI HARJIT SINGH
SHRI R. K. JAIN (Alternate)

HMT Ltd (Tractor Division), Pinjore

SHRI J. S. KHADILKAR
SHRI VINOD R. KULKARNI (Alternate)

Kalyani Brakes Ltd, Pune

SHRI V. R. MARATHE
SHRI P. V. BHANDRE (Alternate)

Kinetic Engineering Ltd, Pune

SHRI R. SIVA KUMAR

Mahindra & Mahindra Ltd, Nasik

SHRI I. V. RAO
SHRI DEEPAK SAWKAR (Alternate)

Maruti Udyog Ltd, Gurgaon

SHRI V. C. MATHUR
SHRI B. N. DAS (Alternate)

Ministry of Heavy Industries & Public Enterprises, Department of Heavy Industry, New Delhi

SHRI K. V. RAMI REDDY

Ministry of Surface Transport, New Delhi

SHRI M. K. MISHRA
SHRI R. G. KAREMORE (Alternate)

Ordnance Factory Board, Calcutta

(Continued on page 10)

IS 11852 (Part 3) : 2001

(Continued from page 9)

Members

SHRI V. R. KULKARNI
SHRI S. RAMANATHAN (*Alternate*)

SHRI S. N. SRINIVASAN
SHRI V. MURUGAN (*Alternate*)

SHRI V. RAMAKRISHNAN
SHRI S. M. IQBAL (*Alternate*)

SHRI VEENU MATHUR
SHRI Y. V. NAGARAJ (*Alternate*)

SHRI P. D. JOSHI
SHRI C. M. MEHTA (*Alternate*)

SHRI L. S. JAYARAMAN
SHRI V. R. JANARDHANAM (*Alternate I*)
SHRI K. N. RAVI (*Alternate II*)

SHRI S. SELVAMANI
SHRI MANOHAR M. HEGDE (*Alternate*)

SHRI S. R. AGARHARI

SHRI V. R. PALUSKAR
SHRI G. R. NAGABHUSHAN (*Alternate*)

SHRI M. N. MURALIKRISHNA

SHRI ANTON FREIESLEVEN
SHRI PAULRAJ EDWIN (*Alternate*)

SHRI K. C. JAIN
SHRI R. K. GUPTA (*Alternate*)

SHRI A. R. GULATI,
Director & Head (TED)

Representing

Pal-Peugeot Ltd, Dombivli (East), Thane

Premier Automobiles Ltd, Mumbai

Rane Brake Linings Ltd, Chennai

Royal Enfield Motors, Chennai

Scooter India Ltd, Kanpur

Sundram Brake Linings Ltd, Chennai

Sundram Clayton Ltd, Chennai

Swaraj Mazda Ltd, Chandigarh

TELCO, Pune

TVS Suzuki Ltd, Hosur

Volvo India Private Ltd, Bangalore

Yamaha Motor Escorts Ltd, Faridabad

Director General, BIS (*Ex-officio Member*)

Member Secretary

SHRI A. K. NAGPAL
Director (TED), BIS

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 1986 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards : Monthly Additions'.

This Indian Standard has been developed from Doc : No. TED 4 (232).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110 002
Telephones : 323 01 31, 323 33 75, 323 94 02

Telegrams: Manaksanstha
(Common to all offices)

Regional Offices :

Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg
NEWDELHI 110 002

Telephone
{ 323 76 17
 323 38 41

Eastern : 1/14 C. I. T. Scheme VIIM, V. I. P. Road, Kankurgachi
CALCUTTA 700 054

{ 337 84 99, 337 85 61
 337 86 26, 337 91 20

Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160 022

{ 60 38 43
 60 20 25

Southern : C. I. T. Campus, IV Cross Road, CHENNAI 600 113

{ 235 02 16, 235 04 42
 235 15 19, 235 23 15

Western : Manakalaya, E9 MIDC, Marol, Andheri (East)
MUMBAI 400 093

{ 832 92 95, 832 78 58
 832 78 91, 832 78 92

Branches : AHMADABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE.
FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR.
LUCKNOW. NAGPUR. PATNA. PUNE. RAJKOT. THIRUVANANTHAPURAM.